FILTERED ULTRA VIOLET *(Black Light)* IN DIAGNOSIS

> **" Most of these epidemics might have been stopped short in their tracks or even aborted if Filtered Ultra Violet had been in the hands of the physicians and the Health authorities in these cities. "**

Filtered Ultra Violet Light is invaluable as a diagnostic agent, because:

1. **It permits accurate diagnosis;**
2. **Also, complete extent of the infection.**
3. **It gives a check on the prognosis.**
4. **It proves complete eradication of infection.**

THE BIRTCHER CORPORATION
Los Angeles, California

The Uses of Filtered Ultra Violet Light in Diagnosis

The use of Filtered Ultra Violet Light in diagnosis in recent times has opened up many new and vastly interesting fields of investigation. This is particularly true in cases involving fungus infections because the various Microspori exhibit characteristic fluorescent color when viewed under Filtered Ultra Violet in a darkened room. Also, very promising work is being done in cases involving the circulation of the blood including the most important field of peripheral vascular disease.

Filtered Ultra Violet, often called Black Light or sometimes Wood's Light, is obtained by passing the radiation of a suitable ultra violet generator through a properly designed quartz glass filter. The filter is usually colored a deep blue-purple and acts to screen out most of the visible light (excepting a small amount of the purple) but allows the passage of most of the invisible ultra violet radiation. Filtered Ultra Violet has the property of exciting fluorescence in many of the fungus organisms as well as in other organic and inorganic substances in nature.

FLUORESCENT DIAGNOSIS IN TINEA CAPITIS

In Tinea Capitis the Black Light excites fluorescence in certain lesions indistinguishable to the human eye under ordinary illumination. Areas of infection caused by either Microsporum Audouini or Microsporum Lanosum will display a brilliant green fluorescence and so permit accurate diagnosis as contrasted to ordinary alopecia, which shows no fluorescence.

But of far greater importance, not only are the larger patches of Tinea Capitis thus visualized but also each individual isolated hair or follicle which is harboring the organisms will fluoresce green. Thus the complete extent of the infection is visualized permitting complete and adequate treatment. It has often happened that while the active patches have been successfully treated, the patient has been discharged while still harboring active organisms in isolated hairs. These cases have not only shown recurrence but have acted as active carriers spreading the infection.

Drs. Lewis, Lindsay and others have pointed out that in Tinea Capitis, Filtered Ultra Violet is invaluable because:

1. It furnishes an accurate diagnosis of the disease;
2. Also the complete extent of the infection.
3. It provides the physician with a rapid means of checking the progress of his treatment;
4. And finally, it serves as a proof of the complete eradication of the infection.

It has been suggested by many Dermatologists of national repute that especially in children of school age, at least two negative examinations under Filtered Ultra Violet should be made before the child is re-admitted to school. Subsequent examination one month later should also be made to obviate the possibility of relapse.

As is well known, there have been several severe epidemics of Tinea Capitis in many cities in recent years in different sections of the country. It has been said repeatedly that many of them might have been either avoided or materially shortened had Filtered Ultra Violet been more generally used and understood. And it is interesting to note that the prevalence of Tinea is not confined to children from the wrong side of the tracks. Actual evidence proves the contrary.

Filtered Ultra Violet is also most useful in cases involving Tinea Versicolor and Vitiligo. Should a youngster appear at the office showing some brown, round spots of geographic outline, somewhat covered by a coating of dirt, Filtered Ultra Violet immediately dissipates all doubt as to what is dirt and what is either Tinea Versicolor or Vitiligo as the dirt does not fluoresce while both of the others do and both differently. Also it has been said that the more precancerous the keratoses, the more they fluoresce white, because of their higher cholesterol content.

PROCEDURE FOR FLUORESCENT DIAGNOSIS

In using Filtered Ultra Violet (Black Light), the examination of the subject should be made in a darkened room so that the fluorescence will show clearly. A short period of time (suggested 3 to 5 minutes) should be allowed before observation to permit the physician's eyes to become properly dark accomodated. It will be most surprising to note how much more detail will be observed if this accomodation time is taken.

To obtain maximum fluorescence, the lamp should be held fairly close to the object, say 4 or 5 inches. It is of primary importance that the surfaces to be inspected should be thoroughly cleansed of all oils and medication in advance. At a well known skin clinic recently, several student physicians were shown a group of Tinea Capitis cases, none of which exhibited fluorescence. At the next session they were shown these same patients who had in the meantime been thoroughly shampooed. The difference was most startling for the fluorescence was now brilliant. It served as a telling object lesson in the necessity for preliminary cleanliness of the field.

TINEA CAPITIS -(Ringworm of the Scalp)

Most writers stress the importance of early and accurate diagnosis of Tinea Capitis. When viewed under Filtered Ultra Violet, the patches and affected hairs exhibit a green fluorescence. Even a single affected hair may be visualized. Accurate diagnosis may thus be made; a progressive study of progress in treatment proves most valuable; and finally, a proof of cure to the physician in charge becomes possible. The final step is most important as often patients are discharged as apparently cured while a few isolated hairs are still harboring microsporum. Lewis stated that the epidemic in New York in 1943 might have been stalled off or at least quickly controlled had "Black Light" been generally available at that time.

Below are listed the organisms responsible for Tinea Capitis and their appearance under Wood's light:

M. Lanosum	fluoresces	green	T. Crateriforme	fluoresces	dull blue-white
M. Audouini	"	green	M. Fulvum	"	light green
T. Violaceum	"	dull blue-white	T. Gypseum	"	none
A. Shoenleini	"	green-gray	T. Sulfureum	"	pale gray

The first two, namely, M. Lanosum and M. Audouini, account for over 80 percent of all cases observed--M. Audouini being more prevalent in the eastern U.S. and M. Lanosum more common in the west. For a more detailed differentiation of the various fungi, the book by Lewis and Hopper entitled "An Introduction to Medical Mycology" (published by The Year Book Publishers, 304 S. Dearborn St., Chicago, Ill.) is recommended.

FLUORESCEIN

Fluorescein is resorcinolphthalein. It is available generally throughout the U.S. It is inexpensive and non-toxic. It has been reported that in tests to determine renal function, doses of one gram have been administered orally without deleterious effects being noted. As much as 6gm. has been given by mouth for staining of the eye with no untoward symptoms following excepting staining of the skin for 12 to 30 hours. Fluorescein is excreted unchanged in the urine. When used in an acid solution, the fluorescence is light yellow; in an alkaline solution, it produces green light.

CIRCULATION TIMING

The patient should be examined in a darkened room. Lange and Boyd report the use of 2 to 4 cubic centimeters of a 5% solution of fluorescein to which 5% of sodium bicarbonate has been added. This should be rapidly injected into the antecubital vein and with a stop watch, the time should be noted when fluorescence first appears in the skin of the lips, gums, tongue and eyelids. This point is sharply defined. The green-yellow color appears quite suddenly so that very accurate measurement of the time interval from injection may be made. The patient may be best examined in a recumbent position following 15 minutes of rest. Lange and Boyd report their tests on 89 normal adults, eliminating any showing signs of hyperthyroidism, from which an average arm-lip time was 17.1 seconds with a minimum of 15 seconds and a maximum of 20 seconds.

In another group of 78 patients showing early cardiac failure or developed cardiac failure, the range of circulation timing was from 20 to 68 seconds with an average of 39 seconds. In severe failure, an increase of fluorescein to 3 to 4 cc. was necessary to compensate for the dilution effect due to the slow circulation.

Thirty-six cases of hyperthyroidism were likewise tested, showing an average circulation timing of 10.6 seconds ranging between 7 and 14 seconds. Nine cases of hypothyroidism tested showed an average of 26 seconds. Lange and Boyd, being among the first to report on this work, presented a most interesting paper in Medical Clinics of North America, May, 1942, New York Number.

Since this method opens a very large field in diagnosis, no attempt can be made here to present more than the mere outline of the subject.

THE FLUORESCENT WHEAL TEST IN PERIPHERAL VASCULAR DISEASE

In the earlier use of fluorescence as a means of testing the adequacy of the circulation in peripheral vascular disease, Lange and Boyd injected a solution of fluorescein into the venous circulation and then in a darkened room, under Filtered Ultra Violet, observed the degree of fluorescence which spread over the skin surface of the extremity under observation. By the relative brilliance of the fluorescence, a judgment of the degree of circulation in the parts was visualized.

Later, Neller and others discovered and announced what they considered a more accurate and complete test. A histamine wheal followed by intravenous injection of fluorescein showed a brilliant fluorescence. This led to further study of the wheal as a diagnostic method. It was pointed out that the skin reaction to injury was such as to lead to repair by nature. The degree of reaction depends on the extent of trauma and the ability of the tissue to respond. A triple response is provoked.

The "red" reaction appears first at the point of injury, regardless of nerve supply or blood flow, being due to the vasodilation of the terminal arterioles and capillaries of the skin. The second element, the "flare" or halo, is said to result from axone reflex causing vasodilation of the larger, muscled group of arterioles of the skin and needs, for its appearance, an intact local nerve supply and normal blood flow. In the absence of either or both of these, it does not appear. The third element is the appearance of a wheal which is stated to be due to an alteration in permeability of the vessel walls and never occurs in the absence of adequate blood flow. Nor is it dependent on nerve supply. It is, therefore, concluded that the wheal alone owes its existence to the single factor of blood flow, and that its presence and depth as displayed by its fluorescent intensity when fluorescein is injected intravenously and viewed under Wood's Light, gives a truer measure of vascular sufficiency.

The discovery by Neller that a simple scratch wheal was just as effective as that caused by histamine greatly simplified the technic and obviated the use of histamine which is said to exhibit certain notable disadvantages. Both Mayo Clinic and Neller report the use of a 20% solution of sodium fluorescein in distilled water. Lange uses 5% solution of fluorescein to which 5% sodium bicarbonate has been added. Neller and Lange inject 5 cc; Mayo Clinic 3 cc. according to reports noted.

SCRATCH-WHEAL TEST METHOD

The legs are exposed from the low thighs to the toes. Either the inner or outer aspect of the legs may be used. The surfaces are cleaned with alcohol thoroughly. A series of superficial scratches are then made at 2-inch intervals down both legs in comparable places and extending to the base of the toes on the dorsum surface. The scratches are made by repeatedly stroking the skin in the same spot (5 to 10 times) with a hypodermic needle, but not deep enough to draw blood. The solution of fluorescein is now injected intravenously and the patient is then observed, being in a darkened room, under Filtered Ultra Violet (Wood's) Light. The wheals will exhibit fluorescence within a minute or two and will continue to do so for some time.

When scratch fluorescence is shown to a certain level and is absent below that point, severe organic vascular impairment is said to exist below the last fluorescent mark sufficient to seriously affect the ability of the tissue to repair itself.

When scratch fluorescence is equally and brilliantly present in all marks, significant organic vascular disease does not exist in the areas. Vasospastic disease does not affect the test and may be responsible for the symptoms. The prognosis in these cases is said to be good.

When scratch fluorescence is present throughout but of definitely decreased intensity below a certain point, a graded degree of vascular disease is said to exist. Immediate prognosis may be good but ultimate prognosis may be doubtful.

Amputation in areas of absent scratch fluorescence may be followed by poor or absent healing and may demand re-amputation at a higher level. Amputation in areas of even reduced fluorescence may be hazardous.

The scratch-wheal method is said to be the simplest and most accurate method for determination of extent and degree of organic vascular disease. It should tell if significant organic vascular disease is present and how severe it is. The method is in use in many well-known and reputable clinics.

FLUORESCENCE FOR DETERMINING THE VIABILITY OF THE BOWEL

Determination of the viability of the bowel in cases of strangulated hernia may often be of critical importance. Reports on a large series of cases of strangulated hernia where resection and anastamosis were carried out showed mortality rates as high as 42.8 percent. In cases where resection was not used the mortality was less than 15 percent. Thus, the decision as to resection becomes of great present importance.

In the actual course of operation, while the abdomen is open, the decision must be made. Surgeons of wide experience admit that the opportunity for faulty judgment is always a possibility. The difficulty of decision naturally lies in the intermediate cases where clear cut conditions are absent. The older methods, which mainly rested on subjective tests and reactions, have been inadequate.

FLUORESCEIN TEST

A suggested procedure may be as follows: After opening the abdomen and exposing the questionable loop of the bowel and releasing it from the strangulation, the operating room should be slightly darkened and the color of the bowel and mesentary observed under Filtered Ultra Violet (Wood's) Light. Fatty tissue itself shows a characteristic yellow fluorescence. Now, 5-6 cc. of a 5 percent solution of fluorescein to which sodium bicarbonate has been added to make a 5 percent solution, is rapidly injected intravenously.

After about 20 seconds, it will be observed that the tissues which previously showed a dark purple color will change and where sufficient circulation is present, will glow with a brilliant fluorescence. Areas where circulation is absent will remain dark purple, non-fluorescent. Segments where circulation is inadequate will show a lesser and patchy degree of fluorescence. These effects are clear cut and are readily observed as the circulation spreads into the serosa.

Often it may be suspected that vaso-spasm may account for a degree of circulatory deficiency. Certain drugs to inhibit the autonomic impulse have been used to help release the vaso-spasm. Fluorescence will spread into those areas so released, thus presenting a clear cut picture of the situation.

This method appears to excel over the older methods involving subjective tests and lends itself to a more accurate decision as to necessity for resection.

REQUIREMENTS FOR ULTRA VIOLET GENERATOR AND FILTER

The choice of a proper generator of ultra violet light and the choice of a proper filter for fluorescent diagnosis become very important questions when viewed from the diagnostic point of view. Lewis, and others who have been interested in the diagnosis of fungus infections, have stated that for the optimum wave length the best fluorescence of microsporum is at approximately 3650 Angstrom Units wave length. While this has not been generally conceded to be true, it is still the considered opinion of several leading Dermatologists. On the other hand, when utilizing Filtered Ultra Violet with fluorescein injected intravenously, it becomes necessary to create fluorescence in the dyes through the superficial skin. Several of the leading authorities on fluorescence say unequivocally that a wave length of 2537 Angstrom Units is decidedly superior for this work.

The Spot-Quartz Lamp fulfills the requirements of a proper generator in that it produces an intense radiation at 2537 AU and a considerable radiation at 3650 AU. This can be readily noted by observing the spectogram as photographed by Dr, Burt of the Burt Laboratories. It will be noted that two areas of brightness occur on the spectogram: one at the 2537 AU band and another at the 3650 AU band. These bright areas indicate the emission of considerable energy in these bands.

Then it becomes necessary for one to choose a Wood's Filter with such characteristics that it will pass both the radiations at 2537 AU and 3650 AU without too much absorption, so that both of the wave lengths may be available in the Filtered Ultra Violet.

The No. 9863 Corning Filter, which is furnished as Birtcher No. 627 Wood's Filter, transmits over 60 percent of the radiation produced at 2537 AU. Inasmuch as the lamp emits a strong band at this wave length, 60 percent of it is more than ample for splendid fluorescent diagnosis. This same filter transmits in excess of 85 percent of the radiation at 3650 AU, thereby passing almost all of the radiation emitted by the lamp at that wave length. It is therefore to be seen that the Spot-Quartz Lamp with the No. 627 Wood's Filter becomes an ideal instrument for use in fluorescent diagnosis inasmuch as it will work splendidly both on an area where fungus organisms are involved and also where fluorescein is injected in the tissue, as it fulfills both of the fundamental requirements.